<Article>Making It Work--The Real Challenge of Globalization for Japan's Automobile Industry

〔論　文〕

MAKING IT WORK : THE REAL CHALLENGE OF GLOBALIZATION FOR JAPAN'S AUTOMOBILE INDUSTRY

Koichi Shimokawa

Part I : The "new" global imperative for the Japanese automobile industry

The Japanese automobile industry has arrived at a major strategic turning point. Following the collapse of the bubble economy in 1991, the Japanese domestic automobile market has experienced a protracted three year sales slump and undergone major structural changes. This has forced the industry to come up with a new strategic response through restructuring and rationalization. Hard-hit by the so-called Heisei recession which followed the collapse of the bubble economy, each of the major Japanese automakers has seen a dramatic worsening of its financial results, to the extent that one wonders what has happened to the competitive strength of the worlds' most powerful global competitors.

The contrast is striking: During the peak years of the 1980s through 1991, when the company's operating results were substantially stronger, the 11 auto manufacturers generated profits in a single year of around ¥1.1 trillion, but within a few years, profits had fallen to less than half at about ¥500 billion, with three of the 11 firms reporting a loss, and several others only borderline profitable.

Until this recession, the Japanese industry had generally experienced nearly constant growth, showing a rising curve of sales, volume and profits. The only times when the industry experienced a decline in production was in 1973 as a result of the first oil crisis, and again in 1981 as a result of the second oil shock and the imposition of voluntary export restraints to the United States. In each case, the reduction lasted for only about a year, with production increases restored already the following year. In the current Heisei recession, however, the industry has experienced an unprecedented two years of straight declines in output. On the two previous occasions, sharply weaker domestic demand had a similarly severe impact, but production cuts were only necessary for one year, in part because of the boost provided by strong external demand. Shortly after the first oil crisis, both the US and Middle East markets showed strong growth; and while exports to the US market after the second oil shock were hampered by the imposition of the VER and the increase in import duties on light trucks, exports to European grew sharply, helping raise overall export levels.

In the Heisei recession, however, domestic weakness was compounded by the fact that it has become increasingly unlikely to hope for a similar export spurt to offset the weakness in the home market, which from a peak of 7.8 million vehicles sold in 1990 declined for two straight years to 6.94 million units in 1992. The reason for the poor export outlook stem from simultaneous recessions in Japan's main export markets in the US and Europe, and heightened trade friction over automobile exports. Furthermore, starting basically from

scratch some 12 years ago, the Japanese automakers have progressively expanded production volumes at their overseas production plants which has supplanted substantial export volume.

For example, while exports to the United States total about 1.65 million cars per year, local production already supplies some 1.60 million cars, and it seems nearly certain that in the current year, locally produced cars will for the first time outnumber those imported from Japan. The strengthening of the yen, which has led to a deterioration of export earnings, has a significant impact on the worsening performance of the Japanese auto industry.

Today, the industry is suffering the consequences of the non-lean practices which it acquired during the "fat" years of the bubble economy. In the space of only three years from 1987 to 1990, the domestic auto market in Japan expanded by a total of about 2 million vehicles, with a dramatic proliferation in the number of individual vehicle variations and the shift to the high-end luxury segments of the market. According to statistics in the White Paper on Labor, the number of basic model types that were produced in Japan essentially doubled from about 200 in 1984 to some 400 in 1991.[1] Naturally, this growth also led to a sharp expansion in the number of different parts used, and with the increase in model types represents a major reason for the sharp rise in fixed costs for the industry. And while a highly efficient new model development system and rapid response times to new model changes are seen as characteristic of the Japanese auto industry, the reduction in the model-change cycle, which arose as a response to the speed-up in new car replacement during the surging bubble years, but eventually came to exceed the real needs of most consumers, led to a sharp rise in R&D related expenses as well.

Today, the most telling evidence of the industry's urgent need to correct the many non-lean practices acquired during this period, and to redefine its economic strategies can be found in the current efforts at rationalization and reorganization. Key elements in this restructuring process will be a reduction by 20-30% in model types, a similar reduction in the number of different parts and components, along with greater sharing, or communization, of such parts, as well as revision of the pace of model changes. These efforts are already well underway, and have also been accompanied efforts to shut down the least efficient facilities and concentrating production in the newest most productive plants.[2] The industry is vigorously pursuing such efforts to eliminate non-lean practices, and it is likely that the results will become apparent through lowering of industry break-even levels with two to three years.

In parallel with these rationalization efforts at home, the acceleration of the industry's global diversification assumes an increasing strategic significance. It's fair to say that while in the near-term, domestic rationalization may pose the greater urgency, in the longer term perspective, the key to the industry's future lies in the direction in which diversification drive evolves.

Broadly speaking, this globalization effort can be divided into two main regional components. One is the further expansion of local production capacity in the industrialized countries of North America and Europe; the other, being the extension of local production arrangements and cooperative division of labor to serve the fast-growing China and South-east Asian markets.[3] The immediate focus is likely to be on the pace at which

localization of management, parts procurement and R&D proceeds in North America, where the number of locally produced Japanese transplant vehicles is rapidly overtaking that of cars imported from Japan.

The logic of localization in Japan's largest overseas automotive market, the United States, is no longer simply an issue of supplementing exports. Rather, localization is now the industry's principal strategic objective in North America, where the ability to produce all the strategically important model types locally is fast becoming a reality. With an estimated investment of $8.6 billion in local production facilities in North America, the Japanese automakers have expanded local production capacity to a total of 2.5 million vehicles per year.[4] The sheer scale of this investment suggests the importance which the success of these operations hold for Japan's automotive globalization efforts.

In its initial stages, the effort focused mainly on transplanting Japanese production systems, training practices, and parts procurement procedures to American soil. This effort that was initially managed for the most part by Japanese specialists in cooperation with the locally-hired labor force. Today, however, the process has entered another phase which centers on transfer of key administrative responsibilities to local employees. Moreover, in line with the bilateral agreement to sharply increase procurement of US-made parts by Japanese automakers signed last year, collaboration between Japanese automakers and local parts and components suppliers at the "design-in" phase of development has also begun to gather momentum. This paper will focus on case material drawn from the experiences of Toyota, Nissan and Honda in these areas, as well as local field research in an effort to gauge how effectively this process of localization is actually taking place along the lines I've described.

Part II: Putting strategy into practice through localization of management

The degree to which the Japanese automakers succeed in implementing the localization of their operations in North America represents the linchpin in their ongoing globalization strategy. The process, broadly speaking, can be divided into three major elements. One is localization of management at factory level, particularly those aspects involved directly with human resource development, especially personnel administration, training, evaluation and Quality Control activities. Two, is further expansion of procurement to widen the relationships with local suppliers in order to raise the level of local content. Three, is the localization of R&D related activities to embrace the entire spectrum of design and development, starting at the "design-in" phase of development.

Naturally, all three of these elements are closely inter-related, and reflect the fact that American employees are taking on an increasingly central role in these areas as production at the Japanese transplant operations moves into full gear. At Honda, which has the longest experience of local production in North America, the focus has been to reduce the number of Japanese nationals on site, from a peak level of some 400. With a view to eventually replacing most of these with local employees, Honda has set up a program to send more than 50 American employees to Japan for postings at headquarters lasting up to two years.[5] The emphasis has thus shifted from sending Japanese employees to assist in setting

up local production and administrative systems, to bringing American employees on-site at Japanese facilities, with the assumption that they will return and play a key role in the localization of management at home. This shift marks a change in the prevailing view that the transplants simply represent Honda's North American operations, to a view that they are becoming self-reliant (though not independent) entities largely managed by local employees of Honda. The basis for instilling such an attitude of self-reliance is the full involvement of American managers and workers in major strategic issues, such as decisions regarding model changes and new model introductions.[6] Needless to say, having a local R & D capacity is a basic condition for establishing self-reliance, but setting up such an operation is itself a function of the degree to which the localization of management and procurement has advanced.

The degree of progress in these efforts differs to some extent among the three major automakers, Toyota, Nissan, and Honda. Significant progress has certainly been made in improving the effectiveness of work habits as local production has been ramped up, with the focus on increasing familiarity with practices such as team-based production, simplification of work procedures to allow more flexible rotation, multi-skilled employees, and so on. In this sense, a form of technology transfer has been accomplished in the successful adaptation by local employees and engineers of the relevant practices which had been developed at the Japanese "mother plants." It is clear that the Japanese transplants focused their initial efforts and substantial investment at achieving these objectives.

While Japanese companies are generally known for their enthusiasm for in-house training, Toyota had to invest several times more to develop a highly organized training system at its Kentucky plant than it would have in Japan. Initially, Toyota's managers in charge of training inexperienced local workers saw training in technical skills as their principal focus, but soon recognized that in order to foster the kind of teamwork needed, they also needed to emphasize inter-personal skills such as speaking and listening, as well as team-based problem solving and so on. These aspects of the training program were well received by local workers.

From these activities in the past five years, the company has accumulated a substantial expertise in all the various hardware and software facets of worker training and education at its local training center,and will continue to place major emphasis on these activities.[7] Yet for all the focus on training, these activities do not preclude the emergence of a variety of problems which are not easily resolved, such as problems related to maintenance of the production line by local workers. In some instances, mechanical problems which might take only 10 minutes to clear up at a Japanese plant might take more than an hour to fix in Kentucky. Gradual elimination of such problems, however, is likely to be a mainly matter of time, as the relevant skills and experiences are gained through on the job training.

The situation is somewhat different at Honda, which has had longer experience with training-related activities. In one example (cited by a Rover employee who happened to be working in Ohio), a problem arose on the assembly line, in response to which the group leaders in charge of areas like painting and welding gather at the problem location and quickly delegated responsibility for determining what impact the stoppage might have on the

flow of cars into and out of the line, as well as the flow of parts and so on, and through joint effort had the problem solved in 15 minutes. One training-related factor, however, is that in the initial start-up phases when much of the activity are new to all the workers, and high levels of motivation and interest tend to be shared by all individual differences in ability are not generally very pronounced. Yet as time goes by, personal skills and motivation are likely to emerge that set some workers apart from others. How the automakers will evaluate (and reward) such differences remain a potentially problematic issue still to be fully addressed.

While pay differentials in Japan tend to be based mainly on the length of service, it remains to be seen how the transplants will resolve potential conflicts over pay between those hourly workers who acquired a broad range of flexible skills in the initial start-up phases compared with those who joined later on. For the time being , such problems are being handled mainly by applying a team-work approach, and only evaluating those employees ranked as team-leaders or higher in terms of their individual performance. Yet by the same token, even hourly workers who want their work to be individually evaluated at Honda may elect to do so, and by fulfilling the necessary qualifications can be promoted up the ranks from team leader to coordinator and so on. There are some employees at Honda, for example, who began as hourly workers, but eventually rose to the position of manager, indeed even to the director level, demonstrating the diversity in individual career opportunities that are available. Even without graduating from college, employees have a path to becoming engineers.[8]

The North American factories of Toyota, Nissan and Honda are essentially non-unionized, in contrast to those factories set up by Japanese companies as joint ventures or collaborative efforts with US automakers which have had to accept UAW representation. Though they may be union-free, however, the Japanese transplants nonetheless face the issue of how to resolve disputes and handle complaints by local employees. Though these plants have been in operation for only about 5-6 years, at most 10 or so years, they have generally accepted the UAW seniority rule with regards to eligibility for job rotations and other work place changes.[9]

In order to improve communications with employees, Toyota for example, conducts a major survey annually, and three smaller surveys, in order to identify potential sources of dissatisfaction. The company also runs a hot-line through which employees can register their complaints and opinions anonymously by phone, and the company has pledged to respond to all of them. In addition, Toyota has instituted a "roundtable" discussion series, at which the president and other top level American managers such as the head of personnel to meet informally with groups of 20-25 employees selected at random. These meetings are held four times a year for each of the three shifts, for a total of 12, and as a rule the workers selected come well prepared to discuss issues of concern to their particular work groups. A fourth effort involves members of the company's labor relations department known as "representators" who go out to different groups n the plant to listen to, and suggest solutions, to a host of everyday problems. By making full use of these communication channels, the company hopes to bring into the open any problems that might otherwise be allowed to fester. For really major issues affecting the livelihood of the entire plant, such

as announcements relating to major increases or reductions in production levels, or other events that might impact working hours, the companies try to address the workers more directly; Honda, for example, using plant-wide voting by employees, and Toyota holding assemblies for all employees.[10]

Other practices, such as participation by local employees in suggestion system and QC Circle activity, have also made substantial progress as the plants have now been in operation for some time. In the case of Toyota, for example, the suggestions received in the early stages tended to focus on matters related to reducing costs through energy savings and reduced waste. More recently, however, suggestions tend to focus on identification of potential defects or mechanical problems along with suggestions for improving them, or simplifying work routines and so on.

At Honda, however, a range of activities including suggestions, safety and participation in QC activities are incorporated into a comprehensive effort called "V. I. P" (voluntary improvement program) to serve as the vehicle for promoting individual participation by employees. Honda's experience has shown that the effectiveness of such activities depend on the degree to which it fosters self-initiative by the employees themselves. While progress has been achieved, Honda's management has to continue to seek ways to encourage further participation. Ultimately, the success of QC activities seems to be a function of how effectively the basic training efforts have taken root. Another way of butting it is that QC activities are likely to fail if they're introduced too quickly before the basic level of training has been achieved.

The real objective of QC activity is to understand why certain kinds of problems occur, and to find ways to resolve them, but to do so effectively requires a high degree of discipline and a strong foundation. If full-scale QC activity is initiated without the involvement of the appropriate core personnel and an appropriate level of training, only the identification of problems is likely to be achieved, but this isn't really sufficient. Without adequate preparation, QC doesn't automatically lead to the most important objective, namely a disciplined discussion of ways to actually solve those problems. The Japanese automakers have recognized that to gain the full benefits of QC circles, they can't rush into it or simply try to impose Japanese methods in a mechanical way. Rather, they are making an effort to develop a group of American leaders who will lead the process of adapting and expanding such activities, and to create the kind of environment in which QC becomes a natural, and consistent, element of the corporate culture.[11]

Thus as we have noted, the Japanese automakers are making significant progress in the area of localizing management. It is expressed in a range of activities centered on production and labor-management practices, in practical training programs, in personnel evaluation and promotion, in complaint resolution and efforts to facilitate labor-management communication, and finally, in the form of voluntary participation in QC activity and suggestion systems. Yet issues still remain to be worked out, particularly in the degree to which local employees, including senior managers in key staff functions such as personnel, general affairs and finances are promoted to strategically important positions, as well as raising the absolute numbers of QC leaders, and introducing individual evaluations at the level of workers on the production level.

Part Ⅲ: Beyond local content to supplier support and "design-in" activities

The expansion of local parts procurement is a pivotal issue in the evolving globalization strategy of Japanese automakers. From an initial local content ratio of perhaps 50% at best, the transplant factories have progressively raised the level of local procurement, including critical engine and drive-train components, to the extent that it is not unrealistic to aim for a 75%-80% level of local content. The bilateral agreement between the US and Japanese governments last year to dramatically expand purchase of American components has added an additional impetus for accelerating efforts to expand relationships with local suppliers. Yet the main obstacles to wider collaboration with local suppliers continue to be found in the differences between Japanese and American parts-supply and purchasing practices. A number of problems in this area still have to be worked out in order for full localization to be achieved.[12]

There is evidence, on the one hand, that the Japanese transplants are developing long-term relationships with local suppliers, and that these suppliers for their part are showing real interest in raising quality levels, shortening lead times, and raising their overall technical capabilities. On the other hand, there are still problems in their ability to supply small lots, to make rapid and flexible design changes, and to provide the transplants with adequate quality assurance. Perhaps the biggest problem derives from the relatively small number of local suppliers (with the exception of the largest US system component makers), that have a full-fledged in-house design and development capability. The vast majority of suppliers tend to build and deliver parts on the basis of highly detailed blue-prints and specs provided by the automakers themselves. By and large, Japanese transplants have not found many suppliers with the ability to respond quickly and flexibly to the needs of their own development system, in the sense of pushing along the development of automotive electronics and new materials not yet in widespread use in the US.

Honda in particular found local suppliers generally uninterested in supplying parts in the relatively small lot sized which its factory required during the initial start-up phases when production was being ramped up to about 150,000 vehicles per year. On top of that, many of the parts which Honda requested where compact, lightweight pieces requiring high precision tooling that could only be made by special order that raised their unit cost substantially. Under these conditions, and with the small lot sizes that prevailed at the time, Honda found it hard to make real progress on localization of procurement, but as production volumes rose to the level of 300,000 vehicles, it began to be seen as more commercially viable by local suppliers, who for the fist expressed interest in Honda's orders.

Yet they initially found Honda's specifications for materials, quality, finish, cost and delivery time so severe that just getting prototypes from local suppliers cost twice as much, and took double the time it would have from Japanese suppliers. Moreover, problems cropped up as local suppliers found it difficult to ramp up from engineering samples to volume production, so that even if Honda was satisfied with the prototypes they were shown, problems emerged as soon as suppliers shifted to volume production. This forced Honda to approach its suppliers and investigate the way products moved from engineering to production, and to offer suggestions on how to solve the problems. Honda initially found

suppliers reluctance to this practice, as suppliers feared it would lead to a leakage of trade secrets or technical know-how. More recently, however, local suppliers have recognized the advantages of working with Honda at this level of detail in terms of winning new business on the basis of what they have learned.

Yet the transplants are still finding it difficult to achieve the necessary levels of quality assurance from local suppliers, and Honda, for example, has found it necessary to conduct strict incoming inspections as suppliers can't guarantee the necessary level of quality. Honda as a rule makes an effort to work with such suppliers whenever problems are found to locate and correct the problems at the source in the suppliers production system. Production in Ohio is now up to the level of 1,500 vehicles per day, but the current inventory of finished vehicles that is kept at the plant is generally no more than 500 cars. For this reason, any problem that halts the assembly line will quickly deplete the inventory on hand, and force an immediate and rapid response. In order for local suppliers to understand the gravity of the situation, Honda has invited local vendors to observe the production process and understand first hand the risk which defective components pose to the operation.[13]

Nissan has experienced similar problems at its plant in Tennessee. The company's procurement activities have been raised to a new level of significance as production expands from the initial Sentra subcompact to include the mid-sized Altima model, as well as the start of engine production at the site. The American vice president in charge of purchasing at Smyrna makes the following comment:

"Procurement is entering a new phase as local content will be expanded to serve the production of engines. Our basic philosophy with respect to procurement is to promote long-term relationships on the basis of mutual trust with those suppliers our meet our strict qualifications and rules for single-supplier vendors. Yet the way we operate has changed over time and will continue to evolve. Originally we purchased various parts and materials on the basis of competitive bidding, and it is true that we experienced some problems with our suppliers. Yet by evaluating them in terms of quality, cost and delivery time, we have seen substantial improvement in reducing defects, and more recently have begun to focus on evaluating potential suppliers on the basis of their technical capability.

"We've found it particularly important to stress technical abilities for suppliers who will be involved in production of new models, and as a result the old competitive bidding approach has largely disappeared. It is not just a model change, as we are adding an entirely new model (the Altima) and have chosen to work with our suppliers to help raise the level of their technology and to collaborate in bringing about a long-term reduction in costs.

We have decided to introduce the target-pricing approach, moreover, as we want to avoid the kinds of misunderstandings that can arise between suppliers' cost estimates and the carmakers future price levels. We began, in the case of the Altima, to test various suppliers, and later set up a new parts procurement group, introduced cost planning and supplier training, as well as VE and VA-based contracts.[14]

With respect to the issue of quality assurance, he notes. "We have a system for rewarding those suppliers who achieve significant quality improvements, but at the same time don't expect that all quality issues have to be handled entirely by the suppliers. Rather,

on the basis of the trust that we've established, we work together to raise quality by exchanging information and know-how. We try to determine what kind of assistance they might require, and what we can do to help, and run our quality standards committee on an open basis to make the information available. GM and other American carmakers are also moving to introduce similar practices such as long-term relationships, quality assessment, target pricing and so on, but this is a relatively new trend for them. At Smyrna, we have done these things from the very beginning, and suppliers are judged on the basis of what they can accomplish by working with us. In this respect, suppliers are competing to be qualified with us.

"We have also entered a new phase in terms of the degree to which suppliers assume responsibility for quality, as we shift from incoming inspection to getting suppliers involved by sending their engineers to Smyrna to investigate and fix whatever is causing the problem.Naturally, to be successful, this requires a high level of openness in providing information to suppliers, and for their part, constant efforts to strengthen their quality assurance standards."

In parallel with efforts to strengthen quality standards, Nissan is also moving to strengthen its local R & D capability through collaborative development efforts with suppliers with whom they have established ties. As Nissan's NDR development center gets involved in the development of finished cars and components, the proportion of parts designed locally will have the effect of strengthening the development capacity of local suppliers over the next several years, as in the past the factory only issued orders for components that had been designed in Japan.

Securing reliable suppliers also becomes more important as Smyrna starts production of engines, and to raise the ratio of locally procured components in addition to simpler parts and materials. In order to do so required finding the kind of systems supplier who can develop and deliver more complex modules, along the lines of the approach used in Japan.

Regarding issues which remain in the area of procurement localization. "While we don't want to go to the extreme of making suppliers completely responsible for a certain component, we want to get local suppliers involved at the initial stages of development. While the objective of procurement localization is obviously to raise the level of local content as high as possible, simply farming out production is likely to weaken the suppliers' technical skills and quality evaluation skills. Depending on the type of component, some degree of in-house production will have to be maintained in order to achieve the most efficient procurement system. Moreover, in order to expand our procurement activities to include engines, we will have to search out and train other suppliers. This is why we have focused on setting up a vendor association which will be open to any vendors that meet certain minimal requirements."[15]

This description of Nissan's local procurement activities may sound somewhat idealistic, as in reality, the effort has just gotten under way and will take considerable time, especially in terms of making progress on quality assurance and VE/VA related activities with local suppliers. With respect to "design-in," as the earlier comment to the effect that a high degree of simultaneous engineering would be difficult to achieve, this has only just entered the phase of trial and error.

Yet by the same token, design-in will become necessary in order to the accomplish the goal agreed to last year of substantially expanding local procurement. The design-in process covers a fairly broad range of different approaches by Japanese automakers, so it is hard to make any hard and fast generalizations. Yet in broad terms one can distinguish two main approaches. One is to make a concerted effort to include local suppliers in the design-in process as local R&D gets underway; the second is to take a more deliberate approach to move to design-in only after carefully nurturing relationships with local suppliers in areas such as purchasing practices, quality assurance, price negotiations and technical assessment. Again, it's hard to generalize as to which factors may make the design-in process easy or difficult, as it depends on a range of factors such as differences in types of components, the technical skills of various suppliers and so on. However, the degree to which Toyota succeeds in localizing procurement through such design-in with local suppliers may come to be seen as a test case, as the company has achieved outstanding results in Japan in working with suppliers to raise their technological capabilities.

The starting point for the evolution of Toyota's parts procurement policies began with the company's thorough effort to gather information on local suppliers as part of its joint venture with GM at NUMMI. Since the start of the NUMMI joint-venture in 1984, Toyota established a parts depot in Chicago whose objective was to conduct exhaustive surveys of the cost, quality, and technical levels of the local supplier industry, including GM's own midwestern parts division. Toyota then tried to determine which components would have a significant impact on the overall quality and performance of its cars, and to strictly distinguish those standards on which it was willing to compromise, and those for which it wouldn't. The know-how which Toyota accumulated during this phase will be increasingly applied at the Kentucky plant. Gradually, the company hopes to shift from relying on blueprints in which all quality, costs, and technical details are specified toward the Japanese system of "approval description" of blueprints, in which Toyota's general requirements are indicated, but vendors are allowed to substitute materials and make other compromises as the situation demands. Such "Toyota blueprints frequently have the effect of enticing suppliers to find the cheapest possible way to meet the indicated requirements.

For the time being, the fact that quality assurance has not been fully achieved by individual vendors, Toyota insists on strict incoming inspection of all parts. The fact that all parts have to be inspected in the US therefore represents a major competitive handicap in comparison with production in Japan. The company also wants to shift to a three-year target pricing approach from the current style of annual price negotiations which it conducts with vendors, yet to do so all at once would be impossible. Price and quality levels are based on standards set in Japan. Yet among American suppliers, some companies may try to tender too low cost estimates to win the initial bidding, but then demand price increases later on. In this regard, Toyota has to advise that vendors actually can supply the parts at the prices which they've quoted. Another factor is that while in Japan, defect ratios tend to be expressed in terms of parts per million, in the US they are still often quoted in terms of percent, that is parts per hundred, and for this reason Japanese makers have to continue in their efforts to raise the tolerance levels of their American suppliers.

At present, the efforts of Toyota's local procurement office focus on the following

areas: One, to ensure that the national vendors' association which Toyota launched in 1990 becomes an effective arena for discussion specific issues related to quality improvement and technical standards, rather than simply letting the twice a year meetings become a social event. Two, to develop a core staff of American purchasing managers who are knowledgeable in the companies procurement policies and technical specs and blueprints, in order to more effectively coordinate relationships with local parts vendors. Three, to use the opportunity provided by the establishment of Toyota's US-based R&D program to integrate all of the various activities such as testing, parts design, offer evaluation, and order placement and so on into a single, effective vehicle, and four, to narrow the selection of suppliers to those companies which meet is criteria and long-term requirements.

Design-in naturally assumes increasing importance in raising local content, but it is also important to change the attitudes and interest on the part of the local suppliers themselves. This aspect has improved significantly over the past 10 years, to the extent that some American components suppliers have opened liaison offices in Japan to facilitate the design-in process. On the other hand, the automakers must also make efforts to help local suppliers understand the benefits that they can get from taking part in the design-in process to prevent misunderstanding. There have been cases in which suppliers have been admitted to the design-in process for certain components then suddenly turn around and raise their prices by 50 %. Nonetheless, the attitude seems to be positive, from which the automakers should take the next step of setting up value-engineering (VE) assessment meetings in order to suggest ways in which suppliers can address problems, for example to suggest how a supplier might switch to using lighter materials after the engineering prototypes have been completed. The goal is to get them to recognize that the design-in can be profitable for suppliers as well.[16]

In addition to the already mentioned efforts at Toyota to improve relations with local parts suppliers, the company has also launched its supplier support center in September 1992, whose objective is to provide additional support to local suppliers. The center provides practical training in design-in and advice on such subjects as Toyota's quality assurance philosophy and ways in which can be systematically applied. Use of the facility is not limited solely to existing Toyota suppliers, but is open to any company that wants to study the Toyota production system. For the time being, the center will work with existing suppliers to develop model practices which can then be passed on to other suppliers with whom it does not yet do business.

It appears that as a result of these efforts to transfer know-how about the Toyota production system, many local suppliers have become more positive about studying its features, yet by the same token, perhaps due to a lack of familiarity, still seem to regard the Toyota system as a kind of magic. For this reason, the goal of the center is to conduct a through investigation of the supplier's operations, and within two weeks to point out all the problems that have been found, and then let the suppliers themselves begin to address their problems within a month, as an effort to wean the companies from its support as soon as possible by recognizing the problems and potential solutions on their own. The center currently has a staff of about 30, including Americans, but it should be recognized that its activities represent a voluntary effort by Toyota to support American suppliers, indeed

American manufacturing industry in general, to become more efficient through rationalization of their operations. Another way of stating it is that the objective is to find ways to make more productive use of the personnel who would otherwise become redundant through such rationalization efforts. The staff at the center includes some American employees who've had experience at Toyota headquarters in Japan, as well as local employees from Toyota's three North American plants who've asked to work at the center. It may be a long drawn-out process, but one can assume that the day will come when they will be able to apply the knowledge they've gained from helping local manufacturers improve their operations to help make Toyota's design-in and "kyosei" collaboration with local suppliers a reality.[17]

Toyota will continue to pursue these two parallel approaches, one to through a broad range of purchasing related activities aimed at encouraging existing suppliers to become more familiar with Toyota practices to move in the direction of design-in, while the second aims to promote understanding of the Toyota production system to a wider range of companies, including those it dose not do business with. Indeed, such efforts to training local suppliers is not limited only to the US, but is highly regarded in other countries in which Toyota has production facilities.

For example, in Taiwan where Toyota has set up production most recently, in 1986, the government also raised the issue of training local suppliers as one of the key elements in its policy for nationalizing its automotive industry.[18] In line with the Taiwan government's strategy of developing the country into a leading production platform, not so much of finished automobiles, as of parts and components, Toyota has already made progress in training local suppliers, working with some of its major Japanese components suppliers. The result has been to improve the quality and technical standards of Taiwanese parts suppliers, whom Toyota regards as important elements in the international division of labor to serve as a bridge to the ASEAN and Chinese markets.

Part Ⅳ: Obstacles and opportunities in localization of R&D activities

As design-in in with local suppliers begins to take root as part of the overall effort by the Japanese transplants to raise their local content, the issue of localizing R&D efforts has also emerged. The local R&D facilities thus play an increasingly important role, not only in terms of facilitating design-in with the design centers, but are vital in providing the original ideas and input for new car development. The issue emerged in the initial phases of local production in the context of raising the quality and technical standards of local parts, but also gained an impetus from the need to develop parts locally. Yet, more broadly speaking, the need for an integrated approach to local design and development, leading to the ability to design entire new models locally, arose from the recognition that they would need such a capability in order to satisfy the diverse needs of the American market, and to develop products which would satisfy the needs of local consumers.[19]

While each of the major Japanese automakers has established design centers and R&D facilities in the US, Nissan and Honda have perhaps made the most progress in the direction of design localization. Nissan's efforts in this area focus on the activities of the San Diego design center, NDI, and the Detroit-based technical center, NDR. The heads of

both organizations are Japanese, but one gets the impression that an American could quite likely be appointed head of NDI, which is now in its 13th year, whereas NDR, which is only six years old, is unlikely to see such an appointment very soon. NDI was from the outset set up draw on the creative talents of its American chief designers, to whom the entire design process was effectively delegated, whereas the R&D center almost inevitably requires a Japanese president, at least for the time being, to accommodate the differences in Japanese and American development systems and administrative matters.

NDI's chief designer, Gerald Hirschberg, who moved to Nissan from GM 13 years ago, relates his experiences prior to his arrival at Nissan, and his basic philosophy of design as follows. "The reason I moved from GM to NDI was that even though I was allowed to do a lot of advanced design at GM, I never felt this contributed very much to the design of real cars. I always felt frustrated by the fact that our work never came to realization. I was pretty fed up with advanced design, and wanted to try my hand at design that actually had something to do with making cars. Instead of pursuing a lot of unrealistic design, I believe the design process should begin with a solid conceptual basis, more directly tied to production, from which the ideas are gradually refined. In automotive design, there are cultural factors as well. The emergence of Japan's small cars opened a new path of learning in the design world, which led me to choose Nissan.

"The nature of design work is shaped by the stringent conditions placed on it, and we can only achieve satisfactory through the challenge of coming up with something new that can pass scrutiny through a series of contests. At NDI, the designers compete with each other, and while we cooperate to the necessary with our colleagues at he Nissan Technical Center in Sagamihara, we also compete to see how these fresh design idea can be translated into actual designs. I have told my staff not just to look at things in terms of design, but rather to consider the role of engineering and technology can play as a source of inspiration and originality." [20]

Furthermore, in terms of the issues confronting NDI today, Hirschberg adds the following: "NDI's role is to serve as a conceptual center, to provide stimulus to NTC in Japan, and to aim for the highest level of automotive design in the world. In order to achieve the best results, both centers pursue parallel projects simultaneously, and by dividing project responsibilities, try to determine what works and what doesn't. There is constant tension between the two organizations, and both are run in a dynamic way to permit as much creative freedom as possible. In terms of priorities, it is important for both of us to recognize our mutual differences, and to work on a basis of mutual trust. It is also necessary at the planning stage to think in terms strategic styling and design. For this to work, it is essential to get timely feedback from Nissan's top management on how our design work fits with the company's strategic plans. Even more than in the past, we have to develop an effective partnership between American and Japanese designers.

Another issue is to study how cultural values are changing, and in order to bring fresh design concepts into the process, we have to have our designers follow cultural and market trends. We make a constant effort at NDI to sharpen our cultural sensitivities by encouraging the staff to go out and have a look at art exhibitions, collections, musical events and concerts. A third point that would be raised in the long-term perspective is to look at

the design and development effort as a creative team, for which we have to develop a design process that always maintains pioneering attitude. Over the long run, the real meaning of localization at NDI is to serve as a key member of the Nissan family that can incorporate the cultural values of both countries and combine market needs with our dreams in a systematic way."

The key to Nissan's success in localization of its development process is the collaboration between its design studios at NDI with the NDR development center in Farmington Hills on the outskirts of Detroit. Starting with the development of the Quest minivan in a joint project with Ford, NDR also developed the prototype for the new Terrano sports utility vehicle, based on an NDI design that had won an internal design competition, and is currently working on the development of its third model. Former NDR president Tanuma, who was the overall director of R&D localization, notes the following:

"The first obstacles we ran into in promoting localization of R&D was the marked difference in the American and Japanese approaches to the management of the development process. They may appear superficially similar, particularly with regards to adopting a more top-down approach or giving priority to a more consensus-based approach, but we will need more time to learn from each other."

There are also differences in the way move the design process along, step by step, whether to take the American approach in which authority and responsibility are clearly defined and the work proceeds in a sequential fashion, or the more Japanese approach in which responsibility is more ambiguous, and the work moves along with the necessary adjustments made at the end.

Another problem stems from the fact that with the exception of some functional components, local parts suppliers do not generally do their own development work, and responsibilities thus differ. So for the time being at NDR, no matter how much time it takes, we still have to do the design work ourselves. But American suppliers have changed their attitudes and have become more positive about doing such development. But in order to make it possible for everyone to work together at the same time, we have to develop a technical support system in which key information contained n CAD-CAM drawings can be used by everyone, rather than becoming fragmented and isolated in the hands of only those engineers working on one or another specific aspect.

The characteristic Japanese approach to overlapping development by a number of teams working in parallel has become well known internationally for its effectiveness in reducing overall development time. But at NDR we can't jump into this overlapping approach all at once and instead have adopted a step-wise approach which is based on clear confirmation of how far the work has progressed at each stage. Having done some development work locally, we've found that we unless we modify the designs, we can't use American-made parts, even though we can't simply bring in Japanese parts either. It's not just the design of parts, however, but the broader picture. I'm constantly reminded of how difficult it is for someone who's grown up in a typical small Japanese home can fully understand the needs and preferences of the American consumer.

There are some areas in which American technology is more advanced, and the fact that some materials such as engineering plastics are much cheaper here, and there are many

parts and components for the body and chassis, as well as electronics such as part circuit designs that can be incorporated in the development process. But in the area of engines and major drive-train components, the level of innovation in Japan is definitely more advanced.The same is true for complex components using engineering plastics, aluminum and castings, in which Japanese products tend to be superior, and of course for tools and dies we're likely to depend on supply from Japan."

Even as it grappled with such problems, NDR played a central role in the joint-development of the Quest minivan with Ford, all the way up to the development of the pre-production prototypes, signing off on blueprints and even tapping the resources of the NTC design center for certain aspects of the development work. Having successfully completed this trial run on the minivan project, NDR was also responsible for the remodeled Terrano sports utility vehicle, as well as a third model which is currently in progress. Indeed, NDR is not only involved in development of automotive prototypes, but is also engaged in more basis research as well as safety-related work, the results of which are transmitted back to Japan. Following an initial 3 -year start-up phase, the next 3 - 4 year period for NDR has focused on developing a suitable supplier network to strengthening the organizational structure needed for developing cars in the United States. In the third phase, which will last until the end of the decade, the center will take on the role of a fully localized independent engineering firm with American management capable of challenging headquarters with new ideas. In terms of staffing, Tanuma says that he wants to promote younger members, as well as creating career opportunities also for mechanical engineers. Priority issues in the near-term are three-fold: To gather a network of local suppliers with the required R&D capability; to simply the extremely complex development and engineering process; and finally, to transfer control of the critical development responsibilities to the right kind of talented local staff.[21]

Mr. Narita, who succeeded Mr. Tanuma as president of NDR, makes the following comment: "Of course NDR's role is to serve as the development for Nissan in North America, but with a staff of only about 500, it does not yet have all the resources needed to handle the entire development process and will therefore have to coordinate on division of responsibilities with Nissan's main development center in Japan. For the time being at least, the division of labor is likely to be as follows: Japan will remain in charge of the design and development of major power train components, chassis, and other "under-the-floor" aspects, while NDR will handle body components, interior, panels, glass, doors and so on.

"A key issue for NDR will be to strengthen local design-in capabilities, and from 1993 on, the development of components for Smyrna. We learned a great deal from our joint-development project of the minivan with Ford, in areas such as their positive management system, for example their inside auditing for safety issue, and by making clear the division of authority and responsibility within the framework of the co-production description, were able to resolve the problems that arose. I would say that Ford was also able to learn about the design-in procedures at Nissan, and our approach to team-work in the development process. But while both sides benefited from the collaboration, this was still "round one" as it were, and it would be an exaggeration that everything went without a hitch. Moreover, as design-in was limited to only a few areas, it would be inaccurate to say

that we really took advantage of true simultaneous engineering. We will need to make further effort to reduce development lead times and lower overall development costs.[22]

In the localization of design and development, Toyota and Honda have generally encountered the same kind of difficulties as Nissan. In Honda's case, the main function of the Honda Research & Development of America (HRA), with only 200 employees, has been to serve a supporting role in the effort to raise local content, but more recently the center has been able to take on some development related work as well. Starting essentially with an effort local procurement as a way to replace parts made in Japan, the effort has grown to include the procurement of parts for simultaneous development and is evolving into a total systematic approach aimed at ensuring uniform quality standards. As for design-in activities, starting with the 1990 model Accord, a number of American companies including TRW visited Honda's Tochigi Research Center and took part in joint development efforts.Since then, the number of parts makers involved on the 1994 Civic has increased substantially. However, it will take until 1995 to install the large-scale equipment needed for local development of power-train and other major components. Yet from the 1994 model year, they intend to draw up plans in accordance with local production levels. At Honda, they've already been doing this with motorcycles and general-purpose engines, and will be able to draw upon their previous experience. But they will not compromise by having to use local parts that don't meet their standards, or which might detract from the overall quality of Honda cars.

To illustrate, in one case they found that a locally made oil-heater had a particular problem with the design that caused it to leak. However, they advised the supplier that they would use the part if the local supplier was willing to make the necessary modifications to prevent the leakage. There are certainly some suppliers who have found it beneficial to allow Honda's quality control specialists into their plants to examine their procedures, and by understanding the Honda approach not only raising their quality standards but also lowering their costs. But the choice of adopting such Japanese-style practices remains that of the suppliers themselves. Yet on the other hand, in selecting local suppliers, Honda tries to look beyond the immediate price issue to try to determine whether the management has the willingness to accept new challenges and delivery schedules.[23]

Thus, while there are individual differences in the way the Japanese automakers have approached the issue of R&D localization, they generally face a similar set of obstacles. A major difference, however, is suggested by the divergent approaches taken by Nissan, to work in conjunction with a US company like Ford on some projects, yet also to push ahead quite aggressively on R&D localization, and that adopted by Honda, which takes a more stringent view on what measures up to the company's standards and image, and is pursuing localization and design-in pace with this outlook. In Toyota's case, the company set up its California design center in the early 1980s, and established its Ann Arbor development center to serve as the focal point for its efforts to support local suppliers for its three North American production facilities at Nummi, Georgetown and Canada.

In general terms, each of the major Japanese automakers are moving ahead to localize development of new body styles, interiors and so on, but not as a rule the major platforms and drive-train components. In terms of model types, the companies have moved ahead first

to develop more sporty niche models locally, such as the Toyota Supra, and the Nissan Exa and Terrano models. In addition, they have also pushed ahead the local development of models that are basically offshoots of major model types, such as the Camry Wagon, and the Accord Wagon, and are gradually seasoning the local component sourcing and design-in process, as well as design work, for models such as the Altima, the new Camry and the new Accord models.

Part V: Conclusion

We have examined the current situation, as well as the major issues, facing the leading Japanese automakers in their globalization strategy, with a specific focus on their efforts to localize their production networks in the United States. In their home market, these companies are confronting the problem of major restructuring of their operations in the wake of the collapse of the bubble economy. The principal objective of this restructuring process is to eliminate the non-lean practices which had sharply increased their break-even levels. The industry is making serious effort to return to the slim and highly flexible system from the excesses which had emerged during the boom period of the bubble, which can be expressed as the degree to which these diverged from the industry's original lean practices.

In the near-term the focus of restructuring and rationalization will be on lowering costs, through such measures as reducing model and parts variations, more sharing of parts, reducing the costs involved in model changes, and so on. To some extent, positive results have already been achieved. However, the fundamental restructuring of the Japanese automotive industry will not end with such short-term cost control measures. Rather, the critical issue will be to what extent the industry can reorganize itself in order to strengthen its ability to cope with down trends in the business cycle and the overall lower growth that is expected, and how to develop a structure that is more recession-resistant. It will have to find a way to evolve from the lean-production system that had proved highly advantageous during the period of high volume growth, to a system that has the necessary degree of resilience to respond to economic fluctuations and recessions, in other words how to implement what might instead be called "lean optimization." This system of lean optimization is not something that will be applied only in Japan. There is no doubt that the pace of the industry's globalization will increase dramatically, given the fact that in 1993 local production will for the first time exceed export of automobiles from Japan. As we have noted in this paper, the localization of management, and of production and personnel in the Japanese transplants has already made substantial progress, but will shift to another level as the industry deals with such remaining issues as fostering of local leaders, and their promotion to top positions, as well as introduction of systems for evaluating the abilities of individual employees. In part procurement, one can say is still going ahead on a trial-and-error basis; and while it is by no means complete, progress is also being made in areas such as the expansion of design-in, VE and VA activities with local suppliers, and a gradual shift to single-sourcing and a long-term supply contracts.

There are still a range of problems that remain unresolved, notably expanding participation by local suppliers n simultaneous projects, strengthening of the suppliers own

in-house technological capabilities and their ability to provide sufficient total quality assurance. To achieve progress on these issues will require a further strengthen of cooperative relationships between each of the Japanese automakers and their local suppliers, but as there is also need for an overall improvement in the overall level of local suppliers and their production systems, an effort such as Toyota's supplier support center will also be closely watched in this regard. Furthermore, these efforts by all the Japanese automakers to strengthen their relationships with local suppliers, and to help them improve through cooperative efforts are not just an issue for the Japanese firms themselves, but will also indirectly benefit the American automakers.

Moreover, while the importance to the Japanese automakers of localizing R&D will continue to grow in significance, the evolution of design-in from now on, and the localization or R&D are inseparable, and the further progress of both holds an important key. However, for the localization of design-in the creative of many American designers hold many things from which the Japanese automakers can learn. An important indication of how successful the Japanese automakers are in localizing R&D is likely to be found in how effectively they are able to manage the significant cultural differences in Japanese and American organizational behavior, as well as how to make effective use of the individuality and creativeness of American designers, within the broader context of the management of R&D organizations through promotion of practices such as simultaneous engineering, teamwork between development groups, as well as the effective coordination of overlapping development by different sections.

As we have shown, in the near term, the focus is on how well the Japanese automakers will achieve "lean optimization" through restructuring and rationalization, but from a longer medium-term perspective, the success or failure of the industry's globalization strategy will have an enormous impact on its future. The decisive element in this strategy will be the degree to which the industry succeeds in localizing operations in the US market which represents its biggest overseas investment, and in developing a global network. In the immediate future, it's readily apparent that there are limits to the number of vehicles which Japan will be export from Japan, and thus the problem arises of how the industry can make a soft landing in terms of reducing those exports and replacing them with local production.In the medium-term, further consolidation of domestic production capacity will become necessary, as a result of the structural shortage of younger workers in Japan, with the result that global production will also have to expand to offset that expected reduction in Japan.In a sense, the process now under way at the overseas operations of Japanese automakers can be regarded as a shift to what might be called "lean hybridization," which is the result of the shift from the initial transplantation overseas of the major features of the Japanese production, parts procurement and R&D systems, to a process of increasing accommodation with local cultures and habits.

In this sense, an experiment is underway to see which elements of the Japanese lean production system are really universal, and adaptable to local cultures and their people.[24] There may well be important lessons to be learned from this process of "lean optimization," and from Japan's experiences n establishing a system in which the excesses that emerged during the boom period of the bubble, such as excessive overtime work and multiple model

variations.

Finally, the strengthening of the global strategy of the Japanese automotive industry will also have an impact on expanding cooperative relationships with the US "Big Three" automakers, in which each of the Japanese car makers all have some degree of experience already. It is likely that the kind of collaborative relationship which Nissan pioneered with Ford will continue to expand, in terms of joint development, joint production, mutual supply of components, and OEM supply of cars and so on. There is thus little doubt that the industry's global strategy will contribute both to the promotion of healthy competition, as well as cooperative relationships with foreign automakers.

Table 1 OVERSEAS NANUFACTURING OPERATIONS

Country	United States of America				
Japanese Maker	Honda			Nissan	Mazda
Type of Entry	Sole Entry			Sole Entry	*Sole Entry
Name of Company	Honda of America Mfg., inc.			Nissan Motor Manufacturing Corporation USA	*AutoAlliance International, Inc. (AAI)
Established	February 1978			July 1980	January 1985
Current Share in Equlty	Honda of America 97.58% Honda 2.42%			Nissan (U.S.A) 100%	*Mazda 50% Ford 50%
Location	Marysville, Ohio			Smyrna, Tennessee	Flat Rock, Michigan
Vehicles/Parts Produced	First Plant Accord	Second Plant Accord, Civic	Engine Plant Engines, Steering Components	Nissan truck (1-ton pay load), Sentra, Engines & Axles	MX-6, 626, Ford Probe
Start-Up	Nov. 1982	Dec. 1989	Sept. 1986	June. 1983	Sept. 1987
Annual Production Capacity	360,000 units	150,000 units	500,000 engines	250,000 units (450,000 in '92)	240,000 units
Employees	6,300	500	1,600	4,800	3,500
Total Investment	$ 883 million	$ 380 million	$ 670 million	$ 1.2 billion	$ 550 million
Affiliated Technical/Design Centers	Honda R&D North America, Inc. Honda Engineering North America			Nissan Research & Development, Inc. Nissan Design International, Inc	Mazda R&D North America, Inc.

Country	United States of America				
Japanese Maker	Mitsubishi	Toyota	Toyota		Fuji, Isuzu
Type of Entry	**Joint Venture with Chrysler	Joint Venture with GM	Sole Entry		Joint Venture
Name of Company	Diamond-Star Motors Corporation	New United Motor Manufacturing Inc. (NUMMI)	Toyota Motor Manufacturing U.S.A., Inc.		Subaru-Isuzu Automotive Inc.
Established	October 1985	February 1984	January 1986		March 1987
Current Share in Equlty	**Mitsubishi 85% Others 15%	Toyota 50% GM 50%	Toyota 20% Toyota (U.S.A.) 80%		Fuji 51% Isuzu 49%
Location	Bloomington-Normal, Illinois	Fremont, California	Georgetown, Kentucky		Lafayette, Indiana
Vehicles/Parts Produced	Mitsubishi Eclipse & Mirage, Eagle Talon & Summit, Plymouth Laser	Prizm, Corolla, Small Truck,	Camry	Engines & Axles	Legacy (Fuji), Small Truck (Isuzu)
Start-Up	Sept. 1988	Dec. 1984	May. 1988	Nov. 1988	Sept. 1989
Annual Production Capacity	240,000 units	300,000 units	240,000 units	300,000	160,000 units
Employees	2,900	3,600	3,500	500	1,900
Total Investment	$ 600 million	$ 1.15 billion	$ 800 million	$ 300 million	$ 500 million
Affiliated Technical/Design Centers	Mitsubishi Motors America, Inc.	Toyota Technical Center USA, Inc. Calty Design Research, Inc.			Isuzu Technical Center of America, Inc. Subaru Research & Design, Inc.

NOTES 1) *Ford became an equity partner in AAI in June 1992, increasing capitalization to $ 760 million, and the company name was changed from Mazda Motor Manufacturing (USA) Corporation to AutoAlliance international, Inc.

2) **Chrysler sold its stake in Diamond-Star to Mitsubishi in October 1991. The plant continues to produce Chrysler vehicle "Others" sharing in equity are Mitsubishi affiliates.

SOURCE JAMA member firms official announcements as of June 1992

Table 1 OVERSEAS NANUFACTURING OPERATIONS

Country	Canada			
Japanese Maker	Honda	Toyota	Toyota	Suzuki
Type of Entry	Sole Entry	Sole Entry	Sole Entry	Joint Venture with GM Canada
Name of Company	Honda of Canada Mfg., Inc.	Toyota Motor Manufacturing Canada Inc.	Canadian Autoparts Toyota Inc.	CAMI Automotive Inc.
Established	June 1984	January 1986	March 1983	October 1986
Current Share in Equlty	Honda 50.14% HAM 49.86%	Toyota 100%	Toyota 100%	Suzuki 50% GM Canada 50%
Location	Alliston, Ontario	Cambridge, Ontario	Delta, British Columbia	IngerSoll, Ontario
Vehicles/Parts Produced	Civic	1.6-liter Corolla sedan	Aluminum wheels	Cultus, Escudo
Start-Up	Nov. 1986	Nov. 1988	Feb. 1985	April 1989
Annual Production Capacity	100,000 units	65,000 units	480,000 wheels	200,000 units
Employees	1,900	1,100	120	2,400
Total Investment	C $ 280 million	C $ 400 million	C $ 43 million	C $ 15 million
Affiliated Technical/Design Centers	—	—		—

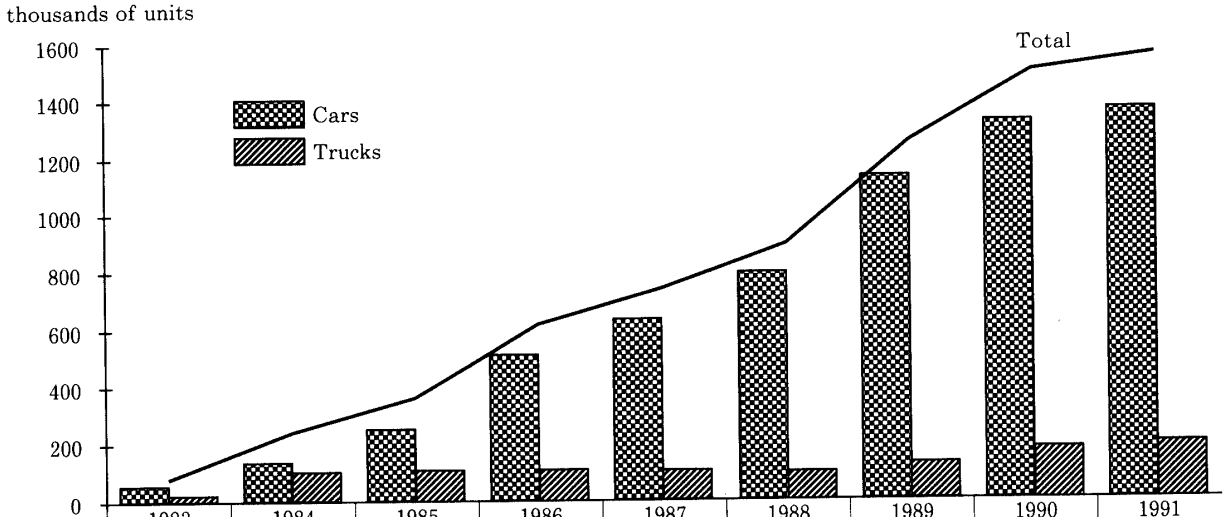
Country	United Kingdom				
Japanese Maker	Nissan	Honda	Isuzu	Toyota	
Type of Entry	Sole Entry	Sole Entry	Joint Venture with GM	Sole Entry	
Name of Company	Nissan Motor Manufacturing (UK) Limited	Honda of the U.K.Mfg., Ltd.	IBC Vehicles Limited	Toyota Motor Manufacturing (UK) Ltd.	
Established	April 1984	February 1985	September 1987	December 1989	
Current Share in Equlty	Nissan 100%	Honda 4.1% Honda Motor Europe 75.91% Rover Group 20%	GM 60% Isuzu 40%	Toyota 100%	
Location	Tyne and Wear. England	Swindon, England	Luton, England	Burnaston, England	Deeside, wales
Vehicles/Parts Produced	Primera	Mid-size Car, Engines	Fargo, Carry, RV	Carina	Engines
Start-Up	July 1986	Oct. 1989	Sept. 1989	Late 1992	Mid 1992
Annual Production Capacity	300,000 units	100,000 cars 70,000 engines	60,000 - 70,000 units	200,000 units (100,000 units in first phase)	200,000 units (100,000 units in first phase)
Employees	3,500	2,000 (planned)	2,100	3,000 (1,700 in first phase)	300 (200 in first phase)
Total Investment	£900 million	¥70 billion	£34 million	£700 million	£140 million
Affiliated Technical/Design Centers	Nissan European Technology Centre Ltd. Nissan European Technology Centre ( ) N.V.	Honda R&D Europe GmbH	—	Toyota Technical Center of Europe Toyota Europe Office of Creation	

Table 1 OVERSEAS NANUFACTURING OPERATIONS

Country	Germany	Spain	Portugal
Japanese Maker	Toyota	Nissan	Toyota
Type of Entry	Joint Production	Capital Participation	Joint Venture with Salvador Caetano
Name of Company	Volkswagen AG	Nissan Motor Iberica, S.A.	Salvador Caetano I.M.V.T., S.A.
Established	–	January 1980	–
Current Share in Equlty	–	Nissan 67.6% Local 32.4%	Toyota 27% Local 73%
Location	Hanover	Barcelona	Ovar
Vehicles/Parts Produced	Toyota Hilux, VW Taro	Safari, Vannette, Trade, Trucks, Parts, Engines & Transmissions	Dyna, Hiace, Hilux, Land Cruiser, Coaster
Start-Up	Jan. 1989	Lan. 1983	Oct. 1968
Annual Production Capacity	5,000 units	80,000 units	12,000 units
Employees	–	6,890	2,225
Total Investment	N.A.	N.A.	N.A.
Affiliated Technical/Design Centers	–	Nissan Motor Iberica, S.A.	–

JAMA 1992 The Motor Industry, pp.16~17

Chart 1 PRODUCTION AT U.S. NANUFACTURING OPERATIONS



	1983	1984	1985	1986	1987	1988	1989	1990	1991
Honda	55,335	138,572	145,337	238,159	324,064	366,335	361,670	435,437	451,199
Nissan	–	–	43,810	65,147	117,334	109,297	115,584	95,844	133,507
*NUMMI	–	–	64,610	191,549	143,652	129,978	192,235	205,287	206.434
Toyota	–	–	–	14,264	43,726	12,527	151,150	218,195	190,453
*Mazda	–	–	–	–	4,200	167,205	216,200	184,428	165,573
*Diamond Star	–	–	–	–	–	2,409	90,741	148,379	153,931
SIA	–	–	–	–	–	–	2,600	32,461	57,945
Subtotal Cars	55,335	138,572	253,757	509,101	632,976	794,371	1,130,180	1,320,031	1,359,042
Nissan	19,979	100,510	107,422	108,048	102,718	95,319	123,056	139,404	131,563
NUMMI	–	–	–	–	–	–	–	–	2,578
SIA	–	–	–	–	–	–	–	34,499	58,352
Subtotal Trucks	19,979	100,510	107,422	108,048	102,718	95,319	123,056	173,903	192,493
Total	75,314	239,082	361,170	617,149	735,694	890,290	1,253,236	1,493.934	1,551,535

NOTE: *Figures include units produced for Big Three automakers (NUMMI/GM. Mazda/Ford. Diamond Star/Chrysler).
SOURCE: Motor Vehicle Manufacturers Association of the United States. Inc.

JAMA op, cit., p.18

Table 2 THE JAPANESE INDUSTRY'S MAJOR AUTOMAKER-TO-AUTOMAKER TIES IN THREE MARKETS

	North America	Europe	Asia
FUJI	· Joint venture assembly plant with Isuzu in the U.S.	· Volvo will supply engines for bus built by Fuji in Japan. · Fuji supplies transmission to Fiat, joit development of same.	· Fuji makes Volvo cars at Subaru dealers in Japan. · Joint venture assembly plant with Taiwan Vespa in Taiwan.
HONDA		· Honda holds 20% of Rover, which holds 20% of Honda UK. · Honda supplies engines& thansmissions to Rover. · Joint development&production agreement with Rover.	· Honda markets Chrysler vehiclec in Japan. · American Honda Motor Co., Inc, holds 13.5% of San Yang Industry, Taiwan.
ISUZU	· GM holds 37.5% of Isuzu. · joint venture assembly plant with Fuji in the U.S.	· IBC Vehicles Ltd., 60/40 GM/ Isuzu. builds trucks for both in the UK with Isuzu engines. · Isuzu supplies diesel engines and transaxels to Opel. · Joint Lotus/Isuzu sports car development.	· Isuzu sells Volvo trucks in Japan. · Isuzu markets Opel and GM cars in Japan. · Isuzu produces GM cars and trucks in Japan for U.S. sales. · Isuzu provides CKD technology to Daewoo of Korea. Daewoo supplies components.
MAZDA	· Ford and Mazda have capital tie-ups; Ford holds 23.9% epuity stake in Mazda. · Mazda produces Ford cars at its U.S. plant for U.S. &Japan sales. · Mazda helped design Ford's Hermosillo Plant in Mexico. · Ford builds Mazda 4 WD(based on Ford design).		· Mazda produces Ford vehicles in Japan for local sales. · Autorama Dealer Network(Mazda/ Ford partnership)markets U.S.-, Japanese-and Korean-made Ford vehicles in Japan. · Mazda does engineering for Ford cars. · Mazda holds 8 % of Kia Motors of Korea, imports Kia-made Ford cars to Japan. · Mazda supplies components to Ford's taiwan plant. · Mazda markets Citrōen and Lancia cars in japan.
MITSUBISHI	· Chrysler holds 5.9% of Mitsubishi. · Mitsubishi makes Chrysler-badged cars at its U.S. plant for U.S. sales. · Joint car development and other cooperation with Chrysler.	· Mitsubishi supplies engine technology to Porsche, Saab and Volvo. · Joint venture with Volvo for joint production in Netherlands.	· Mitsubishi markets Chrysler and Mercedes Benz cars in Japan. · Mitsubishi holds 1.3% of Hyundai Motors of Korea. · Mitsubishi cooperates with nationnal car project in Malaysia.
NISSAN	· Nissan designed and engineered minivans produced in the U.S. by Ford for local sales under both badges. · Nissan USA supplies engines and body panels to Ford minivan produchtion.	· Ford Europe will market Nissan 4 WD vehicles made at Motor Iberica, S.A.(Spain).	· Nissan holds 25% of Siam Nissan Automobile Co., Ltd., 25% of Siam Motor and Nissan Co., Ltd. and 35% of Thai OIC Automotive Industry Co., Ltd. of Thailand. · Nissan holds 5.56% of Ttan Chong Motor holdings Bnd. of Malaysia · Nissan holds 23% of Nissan Motor philippinsses,Inc. of Pillippines. · Nissan holds 25% of Yue Loong Motor Co., Ltd. of Taiwan. · Nissan holds 15% of Mahindra Nissan Allwyn Ltd. of India.
SUZUKI	· CAMI Automotive, 50/50 Suzuki/ GM plant producing cars& 4 WD vehicles in Canada.	· Santana Motor produces Suzuki 4 WD vehicles in Spain.	· Suzuki markets GM and Peugeot cars in Japan. · Suzuki produces GM cars in Japan for U.S. sales.
TOYOTA	· NUMMI, 50/50 Toyota/GM joint venture, produces Toyota& GM vehicles for U.S. sales	· VW produces Toyota pickups for Toyota and VW for sale in the Europen market.	· Toyota dealerships setting up separate outlet network to market VW&Audi cars in Japan.

JAMA op. cit., p.19

Table 3 Wages at Transplant Assemblers vs, Big Three Carmakers, 1989

Company	*Average Annual Earnings*	*Hourly Wages (production workers)*	*Hourly Wages (maintenance workers)*
Ford	$37,434	$16.47	$18.20
NUMMI	$36,013	$16.81	$19.74
GM	$35,462	$16.24	$17.33
Chrysler	$35,371	$16.27	$16.27
Honda	$33,685	$14.55	$16.75
Mazda	$32,970	$15.13	$15.85
Nisssan	$32,579	$13.95	$16.44
Toyota	$29,598	$14.23	$16.28
SIA	$28,995	$13.94	$16.58
Diamond-Star	$28,038	$13.48	$15.58

Source: Kathy Jacison, " Transplant Wages Will Rise to Match Any Gain Made at Big 3 " *Automotive. Vews*(2 Jury 1990), pp. 2 , 60-61.
M.Kenney, R.Florida; Beyond Mass Production Oxford Oniversity Press 1993 p.111

Table 4 Just-In-Time Linkages Between First-Tier Transplant Suppliers and Their Second-Tier Suppliers

Characteristics	*No. of Suppliers*	*prcent*	*Number Responding*
Delivery			
Deliver according to JIT schedule	31	43.0	72
Production Interaction			
Immediate feedback on defective part	70	97.2	72
Customers' engineers visit plant site			
For quality-control problems'	63	96.9	65
For production problems	54	83.1	65
Design Interaction			
Close interaction Between supplier and customer	24	33.8	71
Supplier bids on customer design	44	62.0	71
Supplier can alter customer design	8	11.3	71
Supplier designs subject to customer approval	8	11.3	71
Supplier designs but customer can alter	6	8.5	71

Source: Transplant Supplier Survey, by authors(June 1988).
Kenney, Florida, op. cit., p.143

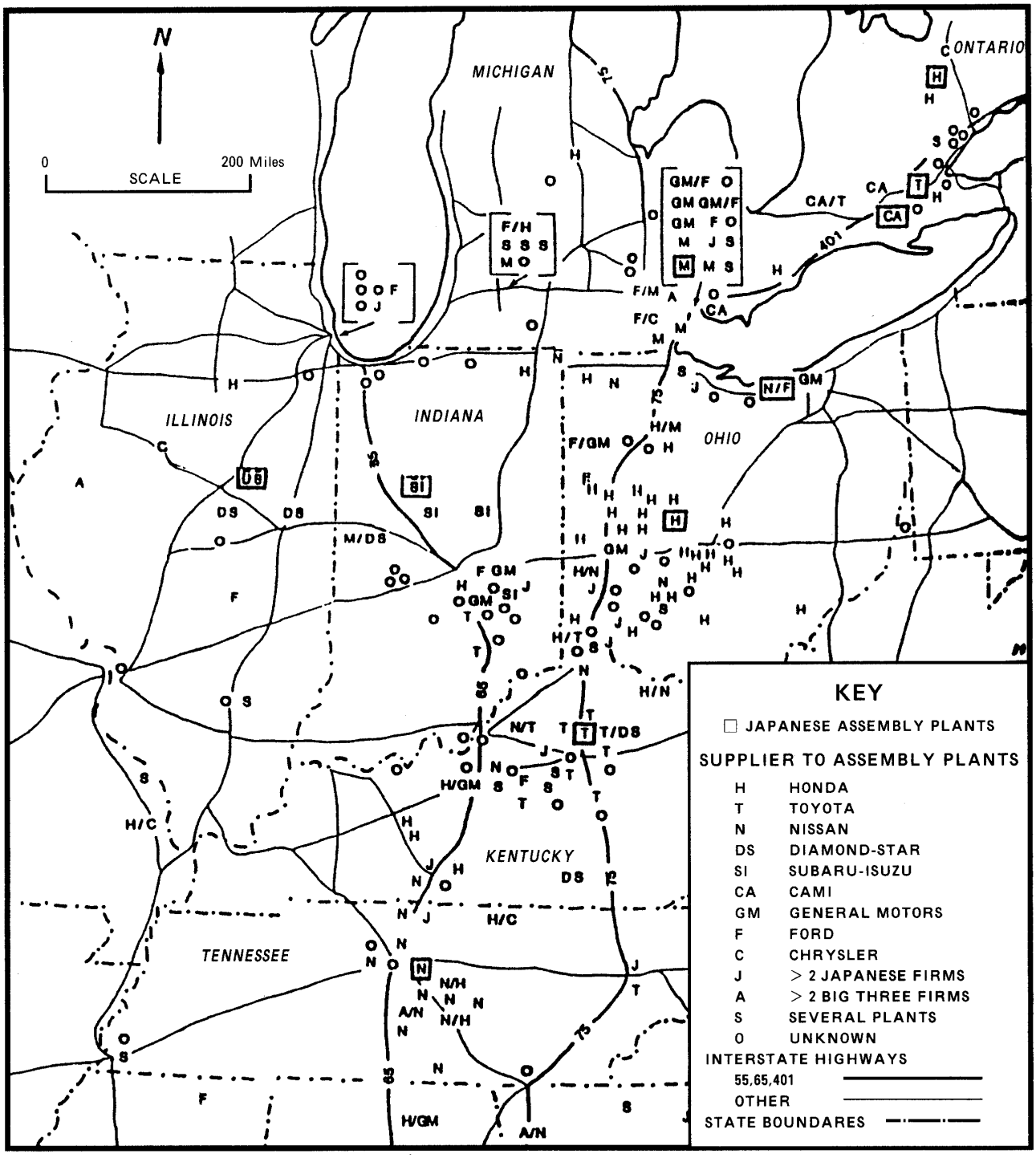
Table 5 Automotive Transplant R&D and design Centers

R&D Center	*location*	*Date Opened*	*No. of Employees*	*Major Function*
Honda R&D of North America, Inc.	Torrance. CA	1975	125	Automotive design
	Marysville, OH	1985	175	Develop prototypes and components; qualify suppliers
Honda Engineering of North America	Marysville, OH	1988	180	Design and develop production equipment
Toyota Technical Center USA, Inc.	Gardena, CA	1977	NA	Vehicle development and testing
	Torrance, CA	1977	82	Prototype testing
	Ann Arbor, MI	1984	48	Evaluate prototype parts; emissions testing
	Southfield, MI	1989	50	Design components and production equipment
	San Francisco, CA	1989	50	Support NUMMI plant
	Lexington, KY	1989	6	Support Georgetown plant
Calty Design Research(Toyota)	Newport Beach, CA	1973	45	Automotive design
Nissan Design International	San Diego, CA	1979	45	Automotive design
Nissan Research& Development	Ann Arbor, MI	1978	NA	Engine and power train research; emissions testing
	Plymouth, MI	1983	400	Parts engineering for U.S. vehicles
Mazda Research& Development	Irvine, CA	1972	85	Automotive design
	Ann Arbor, MI	1988	20	Engineering research, emissions, testing
	Flat Rock, MI	1988	39	Engineering; local parts sourcing
Mitsubishi Design Studio	Cypress, CA	1973	88	Automotive design& engineering
Mitsubishi Motors of America	Southfield, MI	1984	NA	Joint Chrysler-Mitsubishi develoment; emissions testing
Isuzu Technical Center	Cerritos, CA	1985	62	Automotive design&testing
	plymouth, MI	1990	18	Components engineering; emissions Testing
Subaru Research and Design	Newport Beach, CA	1986	13	Automotive design
Subaru Technical Center	Garden Grove, CA	1973	65	Develop and test components and Vehicles

Source: Lindsay Chappell, "The Japanese-American Car," *Automotive News* (November 26, 1990), pp.42-43.

Kenny, Florida, op. cit., p.121

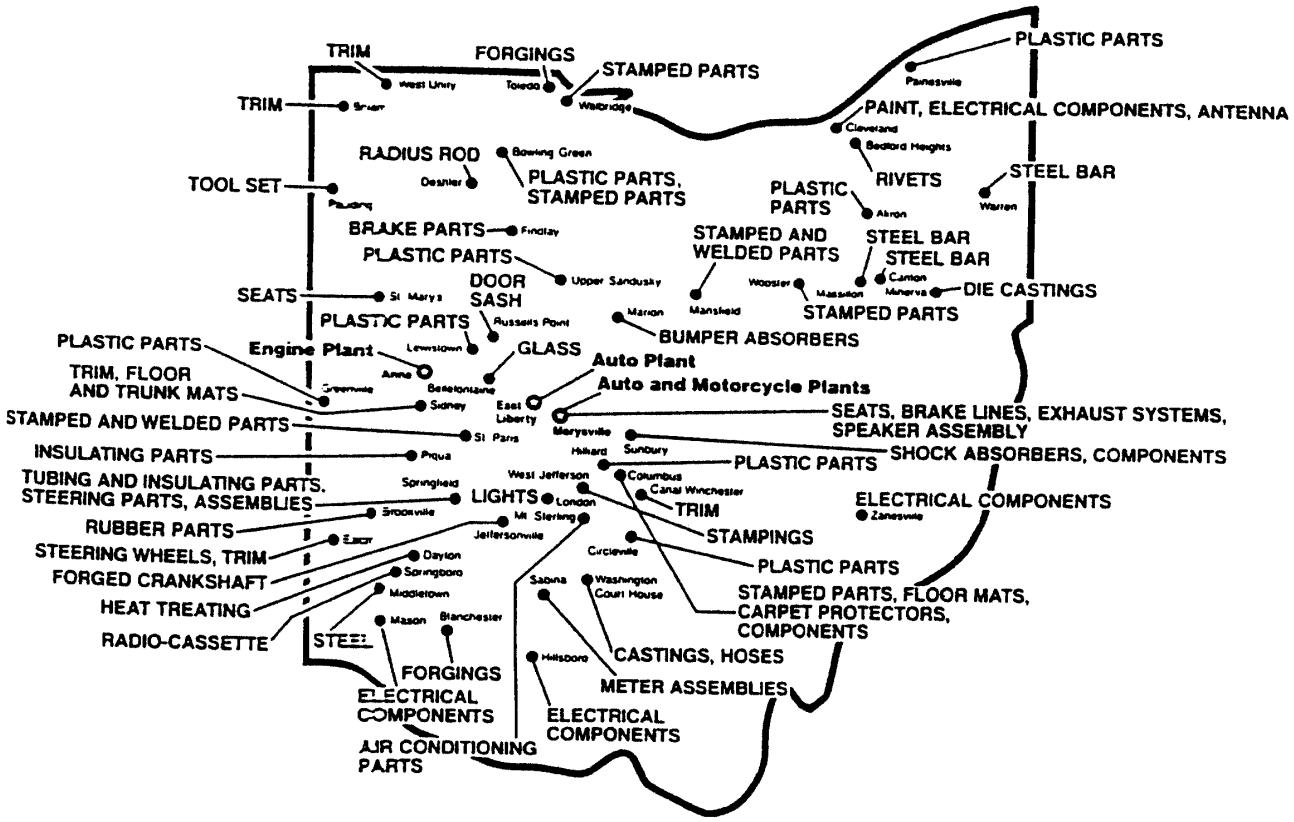
Figure 1 The Just-in-Time Supplier Complex in the Transplant Corridor.



Surcc: Andrew Mair, Richard Florida, and Martin Kenney, "The New Geography of Automobile Probuction: The Japanese Transplants in North America," *Economic Geography*(October 1988), pp.64, 4 .

Kenney, Florida., op. cit., p.128

Figure 2 Honda's Ohio Supplier Complex.



Note: Includes both transplant and U.S. suppliers.
Source: Honda of America Manufacturing, 1991.
Kenny, Florida, op. cit., p.129

References:

1 .Ministry of Labor: "*Rodo Hakusho* (White Paper on Labor)" 1992, p.130.

2 .Koichi Shimokawa: "*Nigemichi naki fukyo, jidosha gyokai no yukue* (No escape from recession: Impact on the Japanese automobile industry)," President, April 1993, p.338.

3 .Koichi Shimokawa: "The globalization and strategy of the Japanese automobile industry," October 1992, IMVP researchers' meeting, p. 3 .

4 .See table 1 .

5 .Interview with Hiroyuki Yoshino, Executive Vice President, Honda Motor Co., September 1991.

6 .Interview with Toshitaka Amino, Vice President, Honda of America Manufacturing, September 1991.

7 .Interview with Fujio Cho, President of Toyota Motor Manufacturing, September 1992.

8 .Interview with Yoshino, op. cit.

9 .Martin Kenney and Richard Florida: "Beyond Mass Production: The Japanese System and it's Transfer to the U.S." Oxford University Press, 1993. p.106.

10.Interview with Cho, op. cit.

11.Interview with Amino, op. cit.

12.Kenney&Florida, op. cit. pp.130-31.

13.Interview with Yoshino, op. cit.

14.Koichi Shimokawa: "*Nissan no genchika senryaku sono jittai to kadai* (Nissan's localization strategy, it's facts and tasks)," Jidosha Journal, January 1991, pp. 9 -10.

15.Ibid., pp. 9 -10.

16.Interview with Mr. Sato, Toyota purchasing department in Detroit, September 1992.

17.Koichi Shimokawa: "On the Toyota supplier support center." Nikkan Jidosha Shinbun, January 27, 1993.

18.Koichi Shimokawa: "The Internationalization of the Japanese Automobile Industry," G.D. Hock and M.A. Weiner, eds. The Internationalization of Japan. Routledge 1992, p.158.

19.Koichi Shimokawa, "*Nissan no genchika senryaku sono jittai to kadai*," op. cit., pp.12-13.

20.Ibid., pp.13-14.

21.Ibid., pp.15-16.

22.Interview with Mr. Narita, President of Nissan Research and Development, September 1992.

23.Interview with Noboru Hashimoto, Vice President of Honda Research and Development, September 1991.

24.Tetsuo Abo, "*Nihon Kigyo no America Genchi Seisan-Jidosha to Denki: Nihonteki Keiei no Tekiyo to Tekiou* (Japanese companies' local production in the United States-automobiles and electronics, adoption and adaptation of Japanese management)," Toyo Keizai Shimposha 1988, pp.29-30.